MEASUREMENT OF THE LOWEST MILLIMETER-WAVE TRANSITION FREQUENCY OF THE CH RADICAL

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The CH radical is an important constituent of stellar atmospheres, interstellar gas clouds and is of fundamental importance to interstellar chemistry. Furthermore, it offers a sensitive way to test the hypothesis that fundamental constants measured on earth may differ from those observed in other parts of the universe[a]. Here, we present a measurement of the lowest millimeter-wave transition of CH, near 535 GHz, with an accuracy of 0.6 kHz[b], an improvement of nearly two orders of magnitude compared to the previous best rest frequencies. We drive the millimeter-wave transitions using the 54th harmonic of a frequency synthesizer phase-locked to a 10 MHz GPS frequency reference. Using ALMA this transition has recently been observed in the absorber PKS 1830-211 at a redshift of $z = 0.89$[c]. As pointed out by de Nijs et al.[d] a very robust and sensitive means to search for variations in fundamental constants could be obtained by observing the lowest millimeter-wave transition of CH along with the two Λ-doublets at 3.3 and 0.7 GHz, all from the same interstellar gas cloud.

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[a] S. Truppe et al., *Nature Communications* **4**, 2600, 2013

[b] S. Truppe et al., *The Astrophysical Journal* **780**, 71, 2014

[c] S. Muller, *private communication*, 2013

[d] de Nijs et al., *Physical Review A* **86**, 032501, 2012